Claim amendments

Claim 1. (Currently amended) A sensor node comprising:

at least one processor;

at least one energy source;

a multiple-mode radio frequency modem operable in both a master mode and a slave mode, wherein while the modem operates in the master mode, the sensor node is configured to control a frequency hopping pattern for a given node remote from the sensor node, and wherein while the modem operates in the slave mode, the sensor node is configured to acquire and follow a frequency hopping pattern of a remote node operating as a master; and ~~to transmit on multiple channels; and~~

at least one substrate coupled among the at least one processor, the at least one energy source, and the multiple-mode radio frequency modem,

wherein the at least one substrate comprises at least one sensor.[[,]]

~~wherein transmission on the multiple channels allows the sensor node to simultaneously join multiple clusters of a network, and~~

~~wherein each of the clusters comprises a respective base node that can communicate with one or more sensor nodes within a range of the base node.~~

Claim 2. (Original) The sensor node of claim 1, wherein the at least one substrate comprises active and passive substrates.

Claim 3. (Previously presented) The sensor node of claim 2,

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wherein the at least one substrate comprises at least one thin film substrate,

wherein the at least one thin film substrate comprises a piezoelectric polymer film, and

wherein the piezoelectric polymer film is polyvinylidenedifloride (PVF_2).

Claim 4. (Original) The sensor node of claim 1, wherein the at least one substrate is conformal.

Claims 5-8. (Canceled)

Claim 9. (Original) The sensor node of claim 1, further comprising at least one communication physical layer including radio frequency (RF) power management.

Claim 10. (Original) The sensor node of claim 1, wherein the at least one processor is coupled to at least one component selected from a group consisting of actuators, sensors, signal processors, interfaces, power supplies, data storage devices, and communication devices.

Claim 11. (Previously presented) The sensor node of claim 1, wherein the at least one sensor comprises at least one sensor selected from a group consisting of passive sensors, active sensors, seismic sensors, acoustic sensors, optical sensors, infrared sensors, magnetic sensors, thermal sensors, accelerometers, and bi-static sensors.

Claim 12. (Currently amended) The sensor node of claim 1,

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wherein the at least one energy source includes a thin film photovoltaic device, and

wherein the thin film photovoltaic device comprises [[is]]an energy source and an optical presence detection sensor.

Claim 13. (Original) The sensor node of claim 1, wherein the sensor node is coupled to at least one item selected from a group consisting of machinery components, electronic equipment, mechanical equipment, electro-mechanical equipment, a facility, a structure, a material, a biological system, people, animals, vegetation, clothing, crates, packages, product containers, shipping containers, a transportation system, vehicle components, an outdoor area, and an indoor area.

Claim 14. (Currently amended) The sensor node of claim 1, wherein the at least one sensor is operable to receive ~~receives~~ at least one signal type selected from a group consisting of temperature, shock, vibration, motion, acceleration, tip, light, sound, and package opening and closing.

Claim 15. (Canceled)

Claim 16. (Currently amended) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including at least one node,

wherein the at least one node is coupled among a monitored environment and at least one client computer,

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wherein functions of the at least one node are remotely controllable using the at least one client computer,

wherein the at least one node is configured to provide ~~provides~~ node information including node resource cost and message priority to the plurality of network elements, and

wherein data processing is distributed through the sensor network in response to the node information.

Claim 17. (Canceled)

Claim 18. (Currently amended) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including at least one node and at least one client computer,

wherein the sensor node is coupled to the at least one client computer through the plurality of network elements,

wherein the at least one node is configured to support ~~supports~~ at least one communication mode selected from a group consisting of wireless communications, wired communications, and hybrid wired and wireless communications, and

wherein at least one redundant communication pathway is established among the plurality of network elements.

Claim 19. (Canceled)

Claim 20. (Previously presented) The sensor node of claim 56,

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wherein the plurality of network elements comprises at least one network,

wherein the at least one network includes a network selected from the group consisting of a wired network, a wireless network, and a hybrid wired and wireless network, and

wherein the at least one network comprises at least one network selected from a group consisting of the Internet, a local area network, a wide area network, a metropolitan area network, and an information service station.

Claim 21. (Previously presented) The sensor node of claim 56,

wherein the internetworking comprises providing remote accessibility using World Wide Web-based tools to data, code, management, and security functions,

wherein the data includes signals and images,

wherein the code includes signal processing, decision support, and database elements, and

wherein the management includes operation of the plurality of network elements.

Claim 22. (Previously presented) The sensor node of claim 56,

wherein the plurality of network elements comprises a plurality of network element sets that are layered.

Claim 23. (Previously presented) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including at least one node,

wherein the at least one node comprises a plurality of node types,

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wherein the plurality of node types includes at least one node of a first type and at least one node of a second type,

wherein a first network having a first node density is assembled using the at least one node of a first type,

wherein a second network having a second node density is assembled using the at least one node of a second type, and

wherein the second network is overlayed onto the first network.

Claim 24. (Previously presented) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network,

wherein code and data anticipated for future use are predistributed through the sensor network using low priority messages, and

wherein the code and the data are downloadable from at least one location selected from a group consisting of storage devices of the plurality of network elements, and storage devices outside the sensor network.

Claims 25-26. (Canceled)

Claim 27. (Previously presented) The sensor node of claim 56,

wherein data processing is controlled using at least one processing hierarchy, and

wherein the at least one processing hierarchy controls at least one event selected from a group consisting of data classifications, data transfers, data queuing, data combining, processing locations, and communications among the plurality of network

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elements.

Claim 28. (Currently amended) The sensor node of claim 56, [[,]]

wherein data is transferred using message packets,

wherein the message packets are aggregated into compact forms in the plurality of network elements using message aggregation protocols, and

wherein the message aggregation protocols are adaptive to data type, node density, message priority, and available energy.

Claim 29. (Previously presented) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including at least one node, and

wherein the functions of the at least one node include data acquisition, data processing, communication, data routing, data security, programming, and node operation.

Claim 30. (Currently amended) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including at least one node,

wherein the at least one node includes at least one processor coupled to a plurality of application programming interfaces (APIs),

wherein the sensor node is coupled to the plurality of APIs to allow control of the sensor node via the plurality of APIs, ~~are coupled to control the sensor node and at least one device selected from a group consisting of sensors, actuators, communications devices,~~

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~~signal processors, information storage devices, node controllers, and power supply devices,~~

wherein the plurality of APIs are configured to support remote reprogramming and control of [[the]]at least one device selected from the group consisting of sensors, actuators, communications devices, signal processors, information storage devices, node controllers, and power supply devices, and

wherein the plurality of APIs are layered.

Claim 31. (Currently amended) The sensor node of claim 30, [[56,]]

wherein the plurality of APIs are configured to enable distributed resource management by providing network resource information and message priority information to the plurality of network elements, and

wherein information transfer among the plurality of network elements is controlled using a synchronism hierarchy established in response to the resource information and message priority information.

Claim 32. (Currently amended) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including at least one node, and

wherein the at least one node is configured to control ~~controls~~ data processing and data transmission in response to a probability of a detected event.

Claim 33. (Currently amended) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including

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at least one node,

wherein the plurality of network elements are configured to self-assemble, ~~self-assembling,~~

wherein search and acquisition modes of the at least one node are configured to search for participating ones of the plurality of network elements,

wherein a determination is made whether each of the participating ones of the plurality of network elements are permitted to join the sensor network using a message hierarchy, and

wherein the sensor network is surveyed at random intervals for new nodes and missing nodes.

Claim 34. (Previously presented) The sensor node of claim 56,

wherein the plurality of network elements comprises a sensor network including at least one node,

wherein the plurality of network elements further includes at least one database, wherein the at least one database includes at least one storage device selected from a group consisting of storage devices coupled to at least one of the plurality of network elements and storage devices of the at least one node, and

wherein the at least one database comprises data-driven alerting methods that recognize conditions on user-defined data relationships including coincidence in signal arrival, node power status, and network communication status.

Claim 35. (Previously presented) The sensor node of claim 56,

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wherein the plurality of network elements comprises a sensor network including at least one node,

wherein data is collected from the sensor node by the at least one node,

wherein at least one operation is performed on the data in response to parameters established by a user,

wherein the at least one operation is selected from a group consisting of energy detection, routing, processing, storing, and fusing, and

wherein the routing, processing, storing, and fusing are performed in response to at least one result of the energy detection.

Claim 36. (Previously presented) The sensor node of claim 35,

wherein the routing comprises selecting at least one data type for routing, selecting at least one of the plurality of network elements to which to route the selected data, selecting at least one route to the selected at least one of the plurality of network elements, and routing the selected at least one data type to the selected at least one of the plurality of network elements.

Claim 37. (Previously presented) The sensor node of claim 35,

wherein the processing comprises selecting at least one data type for processing, selecting at least one processing type, selecting at least one of the plurality of network elements to perform the selected at least one processing type, and transferring the selected at least one data type to the selected at least one of the plurality of network elements using at least one route through the sensor network, and

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wherein the selection of at least one processing type comprises determining at least one probability associated with a detected event and selecting at least one processing type in response to the at least one probability.

Claim 38. (Previously presented) The sensor node of claim 35,

wherein the storing comprises selecting at least one data type for storage, selecting at least one storage type, selecting at least one of the plurality of network elements to perform the selected at least one storage type, and transferring the selected at least one data type to the selected at least one of the plurality of network elements using at least one route through the sensor network.

Claim 39. (Canceled)

Claim 40. (Currently amended) The sensor node of claim 56,

wherein at least one of the plurality of network elements is configured to determine ~~determines~~ a position of the sensor node.

Claim 41. (Currently amended) The sensor node of claim 56,

wherein the sensor node is configured to determine ~~determines~~ at least one position using location information received from at least one of the plurality of network elements.

Claim 42. (Canceled)

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Claim 43. (Previously presented) The sensor node of claim 1, wherein the at least one substrate comprises a thin film tape, and wherein the thin film tape includes an adhesive.

Claim 44. (Canceled)

Claim 45. (Currently amended) The sensor node of claim 1, wherein the at least one substrate is configured to operate ~~operates~~ as an acoustic sensor and source.

Claim 46. (Previously presented) The sensor node of claim 1, wherein the at least one substrate comprises a material suitable for unrolling as a sensor tape to different lengths.

Claim 47. (Previously presented) The sensor node of claim 1, wherein the at least one energy source is a photovoltaic device incorporated in or mounted on the at least one substrate.

Claim 48. (Currently amended) The sensor node of claim 1, wherein the at least one substrate is configured to operate ~~operates~~ as a vibration and acoustic sensor.

Claim 49. (Currently amended) The sensor node of claim 1, wherein the at least one substrate is configured to operate ~~operates~~ as an accelerometer; and

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wherein the at least one energy source comprises one or more battery cells that are configured ~~operable~~ to serve as proof masses for the accelerometer.

Claim 50. (Currently amended) A sensor node comprising:

a flexible substrate configured to operate ~~that operates~~ as an acoustic sensor and an acoustic source;

a processor incorporated in or mounted on the flexible substrate, wherein the processor is configured to automatically join another node to form a network; and

an antenna incorporated in or carried on the flexible substrate and electrically coupled to the processor for wireless communication with the other node,

wherein the acoustic sensor is configured to determine ~~used in determining~~ a position of the sensor node, [[and]]

wherein the sensor node is configured to communicate ~~communicates~~ information identifying the determined position of the sensor node to the other node,[[.]]

wherein the sensor node is configured to synchronize with the other node via radio frequency communications, and

wherein synchronization of the sensor node and the other node allows the sensor node to compensate for wind when determining a range of the sensor node.

Claim 51. (Previously presented) The sensor node of claim 50, wherein the flexible substrate is configured to operate as a sensor in an accelerometer.

Claim 52. (Previously presented) The sensor node of claim 50,

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further comprising a photovoltaic device incorporated in or mounted on the flexible substrate,

wherein the photovoltaic device is electrically coupled to provide an energy source for operation of the processor.

Claim 53. (Previously presented) The sensor node of claim 50, wherein the flexible substrate has an aerodynamic shape suitable for deployment by air.

Claims 54-55. (Cancelled)

Claim 56. (Previously presented) The sensor node of claim 1, wherein functions of the sensor node are remotely controllable and the sensor node is programmable via wireless internetworking among a plurality of network elements.

Claim 57. (Previously presented) The sensor node of claim 50,

wherein the formed network includes a gateway node that links to another network, and

wherein the other network comprises the Internet.

Claim 58. (Currently amended) The sensor node of claim 50,

wherein the formed network includes a gateway node that is linkable ~~links~~ to another network,

wherein the other network comprises a client device, and

wherein the sensor node is programmable by the client device.

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Claim 59. (Previously presented) The sensor node of claim 50, wherein the formed network is operable to detect a sensor node that is attached to a person or to a vehicle.

Claim 60. (Currently amended) The sensor node of claim 50,

wherein the flexible substrate comprises a flexible support material and a layer of polyvinylidenedifloride that is applied to the flexible support material, and

wherein the layer of polyvinylidenedifloride is operable ~~operates~~ as the acoustic sensor and an acoustic source.

Claims 61-62.(Cancelled)

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